AUGUST 1953

ARMY INFORMATION DIGEST

In This Issue:

SURVIVAL INSURANCE. Working with probability curves and mortality tables, insurance experts are able to calculate the life expectancies of various age groups, upon which individual insurance premium rates are based. But the problem of computing the price which must be paid for national security is far more complex. In "Building Strength for Long-Range Security," The Honorable W. J. McNeil, Assistant Secretary of Defense, reviews the concepts and programs underlying the defense build-up of the past two years and looks to the creation of a military establishment which can be maintained indefinitely, if necessary, without becoming a damaging economic burden.

IN THE JULY DIGEST, Dr. John A. Hannah, Assistant Secretary of Defense (Manpower and Personnel) emphasized that the Information and Education Program must be reduced to simple terms and must be made unmistakably clear to the audience to which it is directed. In "Hard Facts for Straight Thinking," the Chief of Publications Branch, Office of Armed Forces Information and Education, calls for a rediscovery of the traditional principles of democracy and at the same time advises against the use of unnecessary frills or a defensive approach which may actually weaken acceptance of the presentation.

LIFE SAVING IN COMBAT. Advances in medical science have so improved the chances of survival in battle that 97.7 percent of those who reach aid stations survive and 85 percent return to duty, records of the Korean fighting show. Two important reasons for this phenomenon are the Mobile Army Surgical Hospital and the hospital ship. Life saving endeavors of the Army and Navy on land and sea are described in "Army Surgical Hospitals at Work in Korea" and "Mercy Is Their Mission."

PLANNING AND PREPARATION required to feed American troops in garrison, in transit and on the firing line are described by the Chief of the Food Service Division, Office of the Quartermaster General, in "Feeding the Army."

SYSTEMATIC ATTACK. The steadily climbing ratio of MIG kills per F-86 losses in the skies over Korea is a direct consequence of methodical Air Force planning, the Commander of Air Research and Development Command reveals in an analysis of the workings of "Air Weapons Development Systems."

ALLIED MAP MAKING. In what is perhaps the largest project in the history of military map making, a common military grid system covering a strategic part of Europe was completed recently in fifteen months. In an article on "The European Grid Conversion Program," the Chief of Army Map Service describes the Army-developed Universal Transverse Mercator Grid system and its significance to the Allied defense effort.

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U. S. Army Photograph

W. J. McNeil

Assistant Secretary of Defense

BUILDING STRENGTH FOR LONG-RANGE SECURITY

W. J. McNeil

IN OUR EFFORTS to maintain the "sound military posture" so earnestly recommended by General George Washington, our Nation must find some way of avoiding the pattern of the past under which we were either at war, which meant complete mobilization, or at peace, which meant complete demobilization. Formerly there were only two settings to our throttle—wide open or tight shut. What our Nation needs now is, clearly, a cruising speed. It is toward this objective that our military program has been aimed for the last two years.

Early in the defense build-up and soon after the entry of the Chinese Communists into the Korean hostilities there were many who urged immediate all-out mobilization. Such a course of action would have involved placing many millions of men under arms and would have required large-scale conversion of industry and the imposition of stringent controls.

If it had been the considered opinion that a crisis would have been reached a year or eighteen months thereafter, this would have been the proper course of action; rather it was felt that the problem was one of dealing with continuing world tensions over a longer and more indefinite period of time.

Before a Senate Committee on 9 December 1950, the then Secretary of Defense General George C. Marshall outlined such a concept as follows: "This is a move to place us in a strong position from which we can go forward rapidly to the extent necessary. This is not full mobilization. This is a raising up of the whole establishment to gain momentum from which we can open the throttle and go very quickly in any required direction. In my opinion, and that of my associates, the way to build up to full mobilization, if that eventually is necessary, is first to get this partial mobilization program straightened out and put it on a very high level—you might say a high plateau—and

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THE HONORABLE W. J. McNeil is Assistant Secretary of Defense (Comptroller). This article is based on an address before the Virginia State Chamber of Commerce.

to do it as quickly, effectively and efficiently as possible."

Under this concept—once the capital investment in new equipment, plant facilities, tools and the like had been made to put the limited mobilization program on a high plateau—the resultant military establishment would be one that might be maintained indefinitely, if necessary, without becoming a damaging economic burden. This concept of partial or limited mobilization, which could be accelerated or slowed down as indicated by the forecast of future events, underlay the military program and budget planning during the defense build-up.

When the Communists struck in Korea in June 1950, the Armed Forces of the United States totaled less than one and a half million military personnel. Our Army was composed of 590,000 men organized into 10 divisions and 12 regimental combat teams, most of which were below peacetime manning levels and lacking supporting organizational units adequate for extensive combat operations. The Navy comprised 376,000 men and had 598 active ships, including 237 warships, of which 7 were large aircraft carriers. The Marine Corps consisted of 74,000 men, organized in regimental combat teams and smaller units, with Marine air power organized in 16 combat squadrons. The Air Force consisted of 411,000 men and 48 wings. Our reserve forces were relatively untrained and unorganized.

Following the Communist attack, the Nation undertook a substantial expansion in the size of our Armed Forces. During this two-year period, the Army was expanded to 1.5 million men organized into 20 divisions and 18 regimental combat teams with collateral units to support them in combat operations. The Navy was more than doubled to approximately 800,000 men and over 1100 ships, including more than 400 warships. The number of large carriers was increased from 7 to 14. The Marine Corps more than tripled in size, expanding to 232,000 men organized into 3 divisions and 3 Marine air wings comprising 30 combat squadrons. The Air Force grew to over 900,000 men and the number of wings doubled.

Even more striking than the growth in strength and forces was the increase in production and deliveries of military equipment and supplies. In the years following World War II our military production base had almost completely disintegrated. Expenditures for major procurement amounted to only approximately two billion dollars a year prior to the Korean invasion. Following the attack on Korea, with the co-operation of American industry a substantial production base for military items

was reconstructed and deliveries of military "hard goods" increased six-fold during the two-year period.

Civilian employment in the Department of Defense on 30 June 1950 was 753,000. As of April 1953 it was approximately 1,300,000 with the great majority engaged in maintenance and repair of equipment, ammunition, aircraft, engines and ships, in supply, procurement and production of military equipment.

During this period it has been the policy of the Department of Defense to acquire sufficient new equipment and supplies to modernize the forces and accumulate a limited amount of stock and then, to the maximum feasible extent, depend on the capabilities of the industrial potential that has been established to provide such additional equipment and supplies as might be required in case of large-scale hostilities.

Efforts have been made to build up only the minimum required stocks of "easy-to-get" items which could be supplied upon mobilization from the known tremendous productive capacity of the United States. As for the "hard-to-get" items, the policy was to establish plant capacity and intermediate production rates which would meet at least a part of the mobilization requirements. At the same time, efforts were made to improve models and take advantage of research and development rather than to freeze design and production on existing models which might quickly become obsolete.

By now, most of the major capital investment in new equipment and facilities has been largely authorized and funded in previous military budgets. As a result of the build-up in military production facilities during the past two and three-quarter years, the Nation has the capability of increasing production materially in the event of full mobilization. In addition, the Armed Forces are now discharging hundreds of thousands of trained men whose skills would be available in the event of need.

As becomes the largest business in the United States, the Department of Defense during the past few years has been endeavoring to install sound management practices in its operations, wherever possible. The Department's drive for increased efficiency and economy will be pressed increasingly by its new leadership which brings outstanding talents in this field.

The magnitude of the problems involved in administering the Department of Defense stems in many instances from the sheer size and scope of the Department's operations. For example, the Armed Forces include more than 4,800,000 people—3,500,000 military personnel and 1,300,000 civilian employees.

Before World War II, everybody knew that a billion dollars was a fantastically large sum of money. Today we have almost become indifferent to the word "billion," and find the word bandied about daily in newspaper headlines. Consequently, it might not seem particularly impressive to state that Department of Defense expenditures, including military assistance programs, amounted to about 47 billion dollars during fiscal year 1953.

The true dimensions of Department of Defense operations can be more readily grasped if we note that the combined sales of the 22 largest industrial manufacturing corporations in the United States—all those with individual sales of one billion dollars or more in 1952—amounted to less than 47 billion dollars.

Soon after the new Administration took office, a complete review was undertaken of the operations of every government department, including the Department of Defense. In this review, complete exploration is being made of every means of insuring more efficient and effective use of the funds and assets of the Department of Defense. In our determination to develop and maintain powerful forces, every item in the program that calls for the spending of dollars is being examined with a view to eliminating those of doubtful or limited value.

During the phase of building up our production capabilities it was inevitable that some of the elements of the program would get out of balance. During the coming months it is intended to make the day-by-day adjustments necessary to keep the over-all program in balance and achieve maximum efficiency. In addition—as was always envisaged since the outset of the defense build-up—as the needs for our operating forces and certain levels of mobilization reserve are met, and as production reaches a plateau, there will be a decrease in the number of plants engaged in active production of military items. This will permit elimination of some of the less efficient, high-cost manufacturers whose productive capacity was temporarily required during the initial build-up stages. It should be emphasized that the Department of Defense is not planning to curtail sharply the mobilization base which has been so laboriously built up since the beginning of the defense build-up. No major change or reversal of this basic policy is contemplated. There will be adjustments, however, to improve the degree of industrial readiness.

During the past several years, our Nation has had to pay a heavy price for the swift and excessive demobilization that followed World War II. We have seen that hasty demobilization, as well as hasty mobilization, greatly increases costs, unneces-

sarily disrupts our economy and tends to increase the demands of the military services which have experienced the painful and frustrating process of feast or famine. Having paid the price once, it would be folly indeed to allow ourselves to be lulled into dropping our guard again, thus inviting new aggression at some time in the future. In this atomic age, it is unlikely that we would again have the wasteful opportunity of building up an adequate defense from scratch.

In the drive to obtain the maximum amount of defense for every dollar spent, a vigorous policy of maintaining and further strengthening forces and readiness will be pursued. Every effort will be made to make the defense program efficient and economical, but it can never be cheap. However, the most expensive step we could ever take would be to repeat the error of World War II and permit ourselves to be panicked into a precipitous cut-back which could invite a World War III.

Any lull or even cessation of hostilities in Korea does not mean that this country can afford to relax its guard. Obviously, we stand ready and willing to participate in any sincere moves aimed toward a settlement in Korea. Nevertheless, we must remember that Korea is only one area in which Communist aggression has manifested itself. Until there is a fundamental change in the long-term Soviet policy the United States must maintain powerful military forces.

We must be careful not to be misled by any tactical maneuvers. As former Secretary of Defense Robert A. Lovett stated some months ago: "To gear our defense effort to the current phase of the international situation would be to place our survival at the mercy of a foreign dictator who can raise and lower at will the international temperature. It makes no sense for us to put on or take off our overcoats depending on whether or not somebody sneezes in the Kremlin. A calm and steady defense position, not blown up or down by the winds of the moment, is not only vital for our national security but is also essential for our position of leadership in the free world. These are the lessons that recent history has taught us, and we can disregard them only at our peril."

AIR WEAPONS DEVELOPMENT SYSTEMS

MAJOR GENERAL DONALD L. PUTT

"AMERICAN SABRE JETS over northwest Korea today shot down two MIG-15s and reported damaging at least one other."

Such communiques had become so common by spring of 1953 that they rated only brief mention in the day's combat reports. Although our Sabre jets were outnumbered and forced to fight in an unfavorable tactical situation, the ratio of MIG-15 kills per F-86 losses continued to climb until by April 1953 it stood at eleven to one.

MAJ. GEN. DONALD L. PUTT

Now as then, the success of our fighters rests upon the pilots, their eyesight, their judgment and their training. It also rests upon the engine-airframe combination, especially upon the margin of performance that we have over the enemy—upon our ability to hit him with bullets and upon the damage those bullets do once they strike.

The F-86s and MIG-15s pitted against each other in the skies over Korea are about equal, performance-wise. The superlative training given the United States pilots is about balanced by the tactical advantage and superior number of the enemy. What is the reason, then, for the increasingly favorable ratio? The answer lies in the fact that the Air Force has developed and now employs a well-balanced weapons system against the enemy.

What is a well-balanced weapons system?

The answer could be a lengthy dissertation but to explain

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it as briefly as possible, the Air Force considers that there are four weapons systems—strategic, air defense, tactical air support and air transport systems plus supporting elements. The four air weapons systems include more than the aircraft complete with armament, radio, navigation, photographic and other integrated systems, each of which has sub-systems. As an integral part of any system, there must be included all the ground supporting equipment, the bases from which the machine operates, logistical supply, maintenance and transportation systems that keep the aircraft in the air plus the back-up of training bases, aircraft and schools which train the pilots, mechanics and other specialized personnel.

Obviously then, to integrate all elements of each system in order to put the best possible aircraft on the take-off line, a vast amount of planning and programming must be accomplished. This requires systems management and systems scheduling to insure that all parts of any given system come out even at the end of the assembly line.

To understand better how the Air Force operates in applying this systems approach to development of our air weapons, consider as a specific example the strategic air weapons system.

In the Office of the Deputy Chief of Staff for Development, at Headquarters, United States Air Force, in the Pentagon, is a small group of officers and civilian scientists known as the Office of the Assistant for Development Planning. Unhampered by the day to day operations of the Air Force, the sole job of these men is to contemplate, think, look into the future and to plan for the weapons that the Air Force should be developing. They compile and interrelate the work of many groups, both military and civilian, who can contribute information, data, analysis or assistance in determining plans for development of future strategic air weapons systems. The end product of their efforts is termed the Development Planning Objective for strategic air operations.

This is a document expressing in rather broad terms the development objectives for a strategic air weapons system. It includes, among many other factors, such general considerations as the required range of an inter-continental bombing aircraft, its probable operating altitudes, probable enemy defenses and how they might best be countered. All in all such a document may cover a ten to a twenty year period.

After several high level reviews, the document becomes a guide for formulation of general operational requirements for

which the Director of Requirements, Headquarters, United States Air Force, is responsible. Here the entire planned strategic air system is broken down into its various components and the operational environment in which the equipment must work is set forth in more specific terms.

The general operational requirements then are transmitted to the Director of Research and Development. Again this Office breaks down the various jobs into development directives which go forward to the Air Research and Development Command in Baltimore for implementation. There the work on each item is allocated among the nine research, development and test centers of the Command. Each center receives directives outlining that part of the work which it will perform.

From now on, the planned objective becomes a management problem to insure that a complete weapons system will be developed and ready for combat at the proper time. This is handled by offices within the Office of the Deputy Chief of Staff for Development, where assistants are responsible for each of the main systems—strategic, tactical, air defense, air transport and the various supporting systems. This same pattern continues within the organization of Headquarters, Air Research and Development Command. Where appropriate, there are similar offices in some of the centers to insure complete integration in systems management and engineering.

Thus from original planning to final production, development of a weapons system proceeds from far seeing, long-range planning down to subdividing the various elements of the plan into specific parts.

A good picture of the thinking, planning, and specific details may be obtained by considering just one component of a system—the day-fighter. In this instance, the objective is to maximize the kill potential of the fighter aircraft. The weapons systems approach which welds the airframe and its armament and equipment into an integrated military machine dictates that the proper balance be preserved among all components or sub-systems. Each must justify its place. Any item that may have a difficult task to perform or which may prove to be a weak link, receives special emphasis, care, selection and exhaustive proof tests before adoption.

To be successful in his mission, the day-fighter pilot must do four things—he must force the enemy into combat, close to effective range, secure hits, and make these hits lethal.

Because these events proceed serially, the probability of a

successful mission is the product of the individual probabilities of successfully accomplishing each step. Obviously then, we are concerned with improving or increasing the product of *all* of the factors, not just any one. The over-all problem might be reduced to the following formula:

$$P_{k/s} = P_e \times P_c \times P_h \times P_k$$

In this formula $P_{k/s}$ is probability of kill per sighting; P_e is the probability of engaging the enemy; P_c is probability of closing to effective range; P_h is probability of hitting and P_k is probability of kills from hits. While here treated in a very general way, the essence of the relationship is that each event is dependent upon the successful accomplishment of its predecessor.

An example will illustrate this interdependence. Our experience is that in Korea, about two and a half MIG-15s are shot down per hundred sightings, or one in forty. Thus the relationship expressed by the formula would read:

$$\tfrac{1}{40} = \tfrac{1}{2} \times \tfrac{1}{5} \times \tfrac{1}{2} \times \tfrac{1}{2}$$

In other words, if 50 percent of the sightings turn into engagements and if 20 percent of these engagements result in the F-86 closing to effective range, and if there is a 50 percent chance of getting hits when in range, and a 50 percent chance that such hits are lethal, then the product is $\tfrac{1}{40}$ or $2\tfrac{1}{2}$ percent.

Accordingly, in considering any changes in our F-86 day-fighter weapons system, all factors must be considered. For instance the installation of a large cannon might be considered since we are getting about as many damaged MIGs as we are getting kills. But even if every round were a 75-mm. shell and every hit were a kill, that $2\tfrac{1}{2}$ percent could only increase to 5 percent—and then *only if all of the other factors were not affected.* But it is obvious that the second term of our equation, the probability of closing, is dependent largely upon the performance of the aircraft—and that would change disastrously as the slight margin of aerodynamic performance disappeared under the weight and drag of the heavier cannon. Therefore an essential factor would be thrown off balance.

The third term, the probability of hitting, may be the margin of over-all performance that accounts for the success of the F-86 over the MIG-15. If so, these fighter engagements are proof of the soundness of our weapon systems concept. They are the measure of the payoff for balanced design. If this is indeed the margin of over-all superiority—and we believe that it is—

it has been obtained through development of what some would call a too complex fire control system. This incorporates a small radar that automatically measures range to target and, through gyroscopes, continually furnishes information of relative speeds and angles of the attacking and target aircraft to a computer which automatically places the correct lead angles into the sight for the pilot.

In present day combat of jet fighters, no human being has the sensory capability to measure the enemy's speed, range and the angles involved. One may see from an examination of the formula that the probability of hitting is particularly critical in that, unless hits are obtained, the net result of the mission is zero, no matter what may be the values of the other factors. It must be a source of great embarrassment to Red leaders that their MIGs are consuming tons of fuel and creating much air turbulence with little or no results.

In considering any weapons system, the degree of complexity of equipment and material must be kept constantly in mind. While it is true that the military have gone overboard at times in complicating specifications, actually the military services have no real desire to have elaborate equipment just for the sake of complexity. Our desire is for the simplest equipment it is possible to produce while still achieving a degree of effectiveness that will assure our weapons' superiority over those of the enemy. Complexity can only be justified when it buys us greater effectiveness per dollar expended. Our problem is to determine at what point the peak of the curve occurs and where the effectiveness per unit cost begins to decrease.

Increasing demands for greater and greater performance from all of our weapons has added to their size, weight, complexity and cost. In all weapons it is desirable to minimize all of these factors. Much progress has been made in the field of miniaturization but even greater progress must be achieved.

Bearing these considerations in mind, the centers which have been given their jobs from Air Force Headquarters and the Air Research and Development Command then plan how they will accomplish the specific tasks allotted to them. Industry is approached and after conducting design competitions or receiving development proposals, the actual development work is done by contractors to the Air Force.

Even in the process of contracting, however, the systems approach has changed Air Force procedures. In the past it was customary to break any particular system down into its

many components and then to contract with many different firms for development of the various components. Now, wherever possible, more and more of the complete system is farmed out to a single contractor who is made responsible for integration of all of the components. The prime contractor then handles subcontracting for many of the components formerly contracted for directly by the Air Force.

All of this planning and programming is not—in fact, by its very nature it cannot be—a hurried process. From original thinking to finished product may require several years. It involves not only a finished product in the form of an airplane but the personnel who will fly it and maintain it and the fields from which it will fly. Having accomplished all this, our hope is for a completed weapons system on time, in proper quantity, of superior quality, integrated into an organization trained for its employment and ready to do battle if ever necessary.

ASSISTANT SECRETARY
OF THE ARMY
(MANPOWER AND RESERVE FORCES)
JAMES P. MITCHELL

ASSISTANT SECRETARY
OF THE AIR FORCE
(MATERIEL)
ROGER LEWIS

ARMY INFORMATION DIGEST regrets that the pictures of James P. Mitchell, Assistant Secretary of the Army, and of Roger Lewis, Assistant Secretary of the Air Force, which appeared in the July 1953 issue were interchanged. The pictures, with the correct titles and names, appear above.—*Editor*.

THE EUROPEAN GRID CONVERSION PROGRAM

COLONEL J. G. LADD

AN ATTACKING FORCE runs into serious enemy resistance. A soldier speaks cryptically into a walkie talkie, carefully enunciating a series of numbers and letters that sounds like a quarterback barking out signals. As a matter of fact, he is calling for a smash play; within minutes, artillery shells are falling on the enemy position.

This pinpointing of unobserved ground fire is accomplished by the use of a map rather than by sight. It is the end result of the signals called by the forward observer. The effectiveness of his signals is governed by the accuracy of the military grid shown on the map.

Much progress has been achieved recently in implementing a program for obtaining greater accuracy and uniformity in military grids. This effort was made possible only through the co-operation of cartographic, geodetic and mathematical experts of many nations in a gigantic program—the converting of thousands of maps of Europe to a single standard military grid.

A military grid reference system provides a means whereby any given spot on a map may be identified quickly and easily by using a series of numbers or a combination of numbers and letters known as grid references. The grid is one of the most important elements to be found on military maps. Its use is twofold—first, it greatly increases the firing accuracy of artillery by facilitating the computation of range and direction; second, it allows any military unit to identify an exact spot to another unit by simply using grid coordinates.

During World War II, considerable confusion arose because the various countries employed their own grid systems. Thus a unit might move a few miles and find that all available maps were based on a different grid which meant that a common point appearing on maps produced by adjoining countries would have entirely different grid coordinates. Obviously a single unified

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system would solve these problems but because time was lacking for converting to any single system, existing maps, however inadequate, were made to serve.

With the end of World War II, the evolution of military tactics emphasized the unsuitability of this heterogeneous system. Under the direction of the Chief of Engineers, United States Army, the Army Map Service developed a new grid—the Universal Transverse Mercator Grid, usually referred to as UTM. By the spring of 1952 the first and most important phase of the Army Map Service's program for converting the many different military grids to the UTM system was completed. This phase resulted in the printing of more than ten thousand different maps covering a strategic part of Europe. Map making agencies of the allied nations co-operated and about forty lithographic firms in the United States were engaged on a contract basis in order to complete the gigantic effort on schedule.

Meridians and Parallels

Cartographers and navigators have long recognized the need for a system for establishing the exact position of any point on the globe by utilizing a system of lines of longitude (meridians) and latitude (parallels). Meridians run north and south from

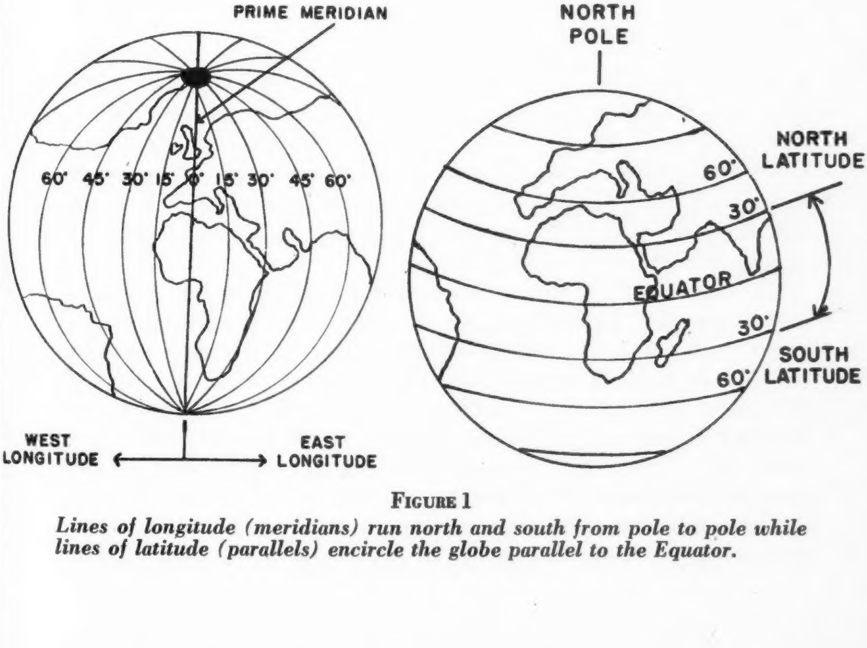


FIGURE 1

Lines of longitude (meridians) run north and south from pole to pole while lines of latitude (parallels) encircle the globe parallel to the Equator.

pole to pole. Since a circle contains 360 degrees, that figure was naturally selected in establishing the number of meridians. Parallels run east and west around the globe, parallel to the Equator and are designated as North or South depending on their relation to the Equator. Each degree is broken down into sixty minutes; in turn, each minute is broken down into sixty seconds.

Obviously some starting point for the numbering of meridians and parallels had to be arbitrarily selected. For the starting point in designating the meridians, map makers have customarily used the famed Greenwich Observatory at London. From this 0 degree or Prime Meridian, the lines to the west are numbered through 180 degrees; those to the east are also numbered through 180 degrees. The parallels are numbered from 0 degree, the Equator, north to 90 degrees at the pole; those to the south are also numbered from the Equator to 90 degrees at the pole. (See Figures 1 and 2).

With this system, navigators or surveyors, by sighting sun or stars and plotting angles according to time or day, can identify their exact latitudinal and longitudinal position on a map, even down to minutes and seconds. Thus a point on the globe might be identified as North Latitude 40°10′23″ and West Longitude 27°14′12″. This would be written N401023W271412. By consulting a map, the exact location can easily be determined. (See Figure 2).

Even with this system of establishing geographic coordinates, however, confusion arises because various countries established their own Prime Meridians at locations other than that running through Greenwich. France, for instance, uses the Paris Meridian while Italian maps are printed with the Rome Meridian established as 0 degree. Thus in using many foreign maps, it is necessary to read carefully the marginal data and to adjust for the Greenwich Prime Meridian.

Map makers have always encountered difficulties in attempting to portray, on a flat sheet of paper, the curvature of the earth. It is a fact that at the Equator, each meridian will be, roughly, 69 plus miles apart. But since the lines converge toward the poles as they move north or south from the Equator, the distance between the lines diminishes until zero is reached at either pole. On the other hand the distance between parallels remains comparatively fixed.

Through the years, map makers have devised and adopted various "projections"—methods of projecting the curved surface

FIGURE 2

A system of geographic coordinates is used in locating various points on the globe. Point A is latitude 40° 00′ 00″ N, longitude 15° 00′ 00″ E. Point B is latitude 15° 00′ 00″ S, longitude 30° 00′ 00″ E. Point C is latitude 15° 00′ 00″ N, longitude 15° 00′ 00″ W.

of the earth on a flat piece of paper. Probably the simplest method is to envelop a globe with a cylinder or cone placed at a tangent plane against the surface of the globe; then there are projected upon the cylinder, cone and plane the desired portion of the geographic coordinate system (the meridians and parallels). The cylinder or cone is cut open and flattened out and the map is then constructed upon the projection.

Types of Map Projections

Five of the more common projections—Mercator, transverse Mercator, conic, polyconic and polar stereographic—are briefly described as follows:

The Mercator projection is constructed by projecting the meridians and parallels onto the surface of a cylinder which is tangent to the globe at the Equator, and then developing this cylinder on the map. The meridians and parallels all appear as straight lines, the meridians being equally spaced while the distances between parallels increase toward the poles. This

causes distortion as the distance increases from the Equator until, on a map based on this projection, Greenland will appear larger than South America. This projection is seldom used beyond 80° latitude because at the poles the expansion would be infinite. (See Figure 3.)

The transverse Mercator projection is developed on a cylinder tangent along any given great circle formed by two meridians. Obviously the axis of such a cylinder is at right angles to, or "transverse" to, the axis of a cylinder tangent at the Equator. Whereas the Equator is the only line true to scale in the ordinary Mercator projection, the central meridian is the only line true to scale in the transverse Mercator. All parallels except the Equator are curved lines. Meridians converge at the poles, are curved lines with the exception of the central meridian, and intersect the parallels at right angles. This projection is conformal—that is, angles measured on the projection or computed from the coordinates closely approximate their true values; at any point corrections of length are the same in all directions. Since distortion in scale in the transverse Mercator projection is relatively slight near the central meridian, this projection serves well for areas which are narrow from east to west and relatively long from north to south.

The conic projection is based on a single cone. This cone is assumed to be tangent to the globe along the middle parallel of the map projection, with the apex of the cone lying in the prolongation of the axis of the globe. At the line of tangency where the cone is tangent to the globe, there is always perfect correlation of earth and map conditions. That is, the map is true to scale along that line. All meridians are shown as converging straight lines that meet at a common point beyond the limits of the map. All parallels are projected as concentric circles whose center is at the point of intersection of the meridians. Thus the parallels and meridians will intersect at right angles and the angles formed by any two lines can be correctly presented. This projection is specially suited for maps having a greater east-west dimension than north-south.

The polyconic projection, as its name implies, is developed on a series of cones. Since in the conic projection, described above, the map is true to scale only at the time of tangency, where the cone touches the globe, by the use of a number of cones (polyconic) the map becomes true to scale at each line of tangency. In the development of the polyconic projection, each parallel is drawn as an arc of a circle with its radius equal

to the distance between the line of tangency and the apex of the cone for that latitude. The meridians are curved lines, with the exception of the central meridian which is straight. Since the parallels are not arcs of concentric circles, the interval between them increases with the distance from the central meridian, as does a real distortion. This projection is suitable for mapping areas of little longitudinal and unlimited latitudinal extent.

The polar stereographic projection is a conformal projection in which the meridians radiate as straight lines from the pole—at the center of the projection. The parallels are complete concentric circles, the pole at their center. Scale distortions are relatively slight in the polar regions. This projection is normally used above 80° north latitude or below 80° south latitude.

Geographic coordinates lend themselves very conveniently to locating cities or towns on a map. However, for the exacting requirements demanded by military tactics, such as the precise control of long-range artillery fire, the general type of reference afforded by the geographic coordinate system is entirely inadequate unless a vast amount of computation is undertaken. When one considers that in military operations an enemy position must be pinpointed to within a few feet, it can readily be seen that a plane system of reference must be devised to compute exact distance and direction easily and rapidly in the field.

Military Grid Systems

To remedy the faults inherent in a geographic coordinate system, the French, just prior to World War I, devised a grid system for fire control. They found it in the rectangular coordinate system used in surveying. A rectangular coordinate (grid) system consists of two sets of equally-spaced parallel lines mutually perpendicular to one another forming a pattern of squares. With most systems a geographic point is arbitrarily selected as a point of origin for the lines. This fixes a definite relationship between any point located by means of the grid and the actual geographic position of the point.

With the success of the French-devised grid system apparent, other countries followed suit and soon developed their own grid systems. Thus, during the global struggle of World War II, allied forces had to rely on some hundred-odd grids which differed in characteristics, projection and unit of measure.

The need for a common grid system was plainly shown and felt during the joint operations of World War II. After the war, the many grids which had been used were reviewed with the object of finding a system which would be simple, uniform

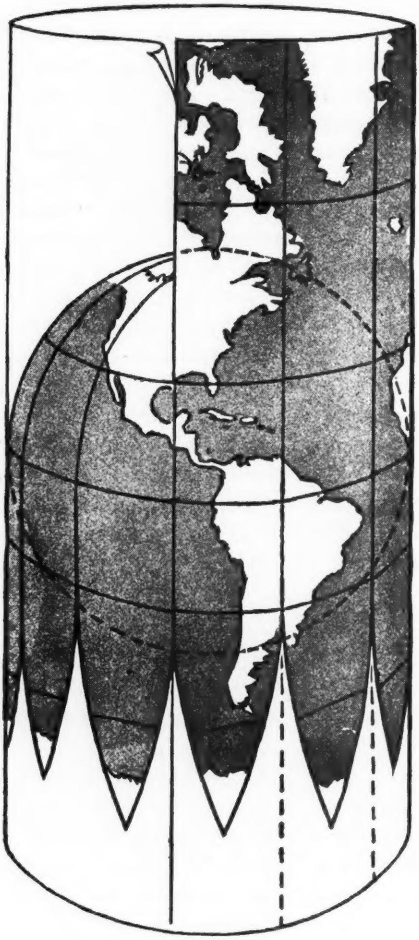


FIGURE 3

The Mercator map projection is constructed by projecting meridians and parallels onto the surface of a cylinder tangent to the earth at the Equator. Distortion increases with distance from the Equator, reaching infinity at the poles. For this reason, this projection is seldom used beyond 80° of latitude.

and capable of world-wide application. After much study, the Army Map Service developed the Universal Transverse Mercator grid system, based on the transverse Mercator projection.

With this system the globe is divided up into 60 grid zones, each 6° east-west and extending from 80° south to 80° north. The zones were limited by these parallels since beyond them the rapidly increasing convergence of the meridians would make the grid impractical in use. These 6° wide grid zones are identified by numbers. Starting at the 180° meridian and proceeding eastward around the globe, these UTM grid zones are numbered 1 through 60 consecutively. The central meridian and the Equator were chosen as the origin for each grid zone. The northing line at the Equator was given the value of 0 meters for the northern hemisphere and 10,000,000 meters for the southern hemisphere. The easting grid line coinciding with the central meridian of each zone was given the value of 500,000 meters. Because of its almost universal use, the meter was chosen as the unit of measure for the UTM grid system.

The UTM grid covers the globe between 80° north latitude and 80° south latitude. Practically all of the land mass and the populated areas of the world lie inside these limited parallels. The remaining regions, located within 10° of each pole, are covered by the Universal Polar Stereographic (UPS) grid.

In order to simplify referencing, a military grid reference system was designed for use with the UTM and UPS grids. For convenience, the globe is divided into large rectangular areas, uniform in size, each of which is given a grid zone designation. Between 80° North and 80° South the globe is divided into rectangles which are 6° east-west by 8° north-south. The columns (6° wide) are identified by the UTM zone numbers. The rows (8° high) are identified by letters. Starting at 80° south latitude and proceeding northward to 80° north, the rows are lettered alphabetically C through X with the letters I and O omitted. The grid zone designation of any 6° EW by 8° NS rectangle is determined by reading right-up, first the column designation, a number, and second the row designation, a letter. In this manner any of the large rectangles can be quickly identified. (See Figure 4.)

Within each particular area, a further breakdown is made into 100,000 meter squares. Each of these squares is identified by a two letter designation as BB, CB, and so on. (See Figure 5). Each 100,000 meter square is divided into 1000 meter squares, and these may be subdivided still farther. Thus by using an

identifying series of letters and numbers, any point down to a square meter may be identified.

However, the entire problem was not solved as easily as this might indicate. In effect, it became two problems, because mapping by European countries had been going on since the beginning of the eighteenth century.

Often a point appearing on maps produced by adjoining countries would have entirely different geographic coordinates. Gaps and overlaps were particularly evident along international boundaries. From the military standpoint, the situation created a difficult problem in control of artillery fire. After 1945, with growing emphasis on new long-range weapons, such erratic conditions could not be tolerated.

By necessity, maps used during World War II were not always the best of any particular area. True, excellent maps of native origin existed for some areas of Europe—France, Denmark and the Netherlands especially. But unfortunately for the Allied forces, very little reproduction material or even copies of these maps were in the possession of the British or ourselves. When the Nazis swarmed over Europe, it became impossible to get much of the mapping materials off the Continent. Maps for our invasion forces were therefore reproduced from out-dated base maps and aerial photography.

At the close of the war, huge stocks of these maps were declared surplus and were disposed of to commercial firms who ground them up for pulp. In a short time the stocks, poor as they were, had dwindled to a dangerously low level.

New Maps for Old

It soon was obvious that besides adopting a universal grid system, entirely new maps would have to be produced if the North Atlantic Treaty Organization forces were to be properly supplied. Desirably, such maps should be based on a common European horizontal datum—that is, a common point of origin for the horizontal position—regardless of national origin, in order to facilitate the adoption and application of the standard military grid and grid referencing system.

Fortunately work already had been started on such a project. In April 1945 a military intelligence unit of the U. S. Army Engineers had discovered in a captured German town the trigonometrical computing section of the *Reichsamt fur Landesaufnahme*, recently evacuated from Berlin to avoid the bombings. This organization with its technical personnel, geodetic records and equipment was moved to Bamberg, Germany, where

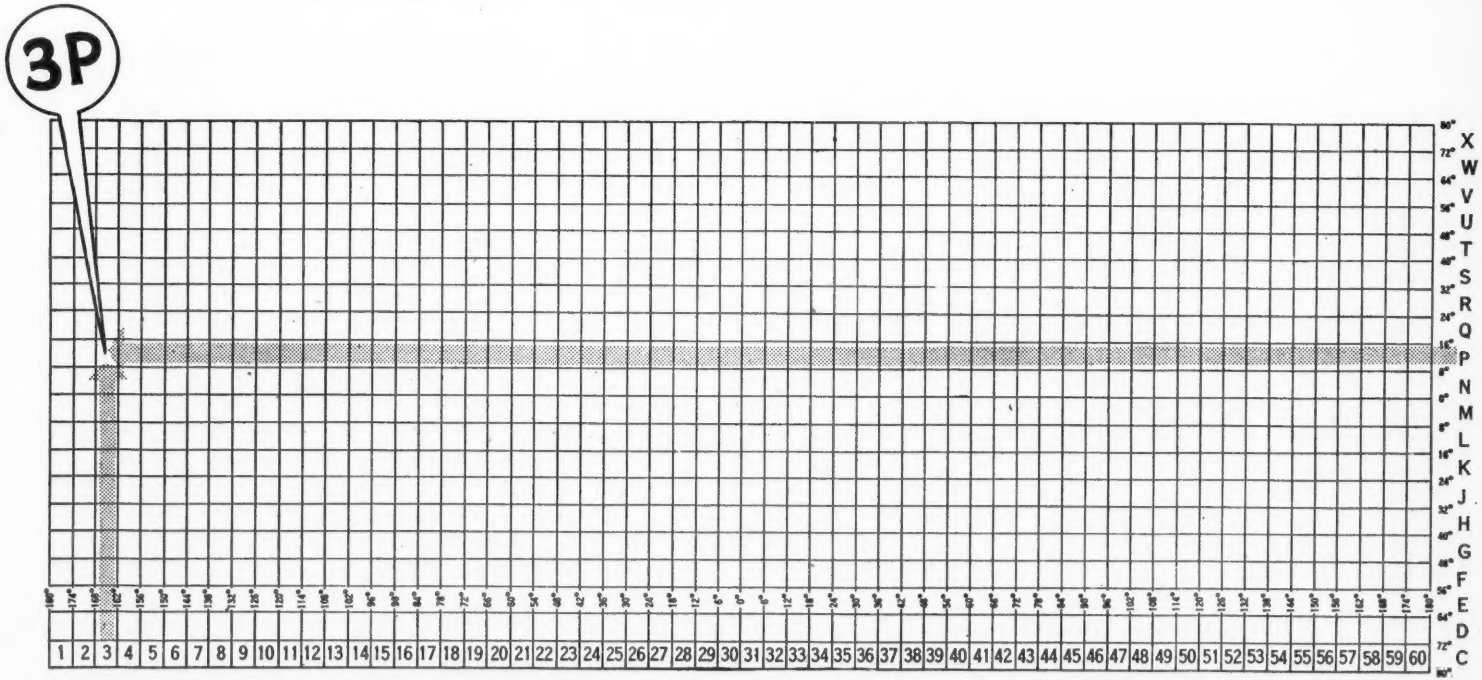


FIGURE 4

Under the Universal Transverse Mercator military grid reference system, the globe is divided into quadrilaterals, each of which is given a grid zone designation. Columns are identified by numbers, rows by letters. The grid zone designation of any rectangle is determined by reading first the column, then the row designation, as in the example, 3P, above.

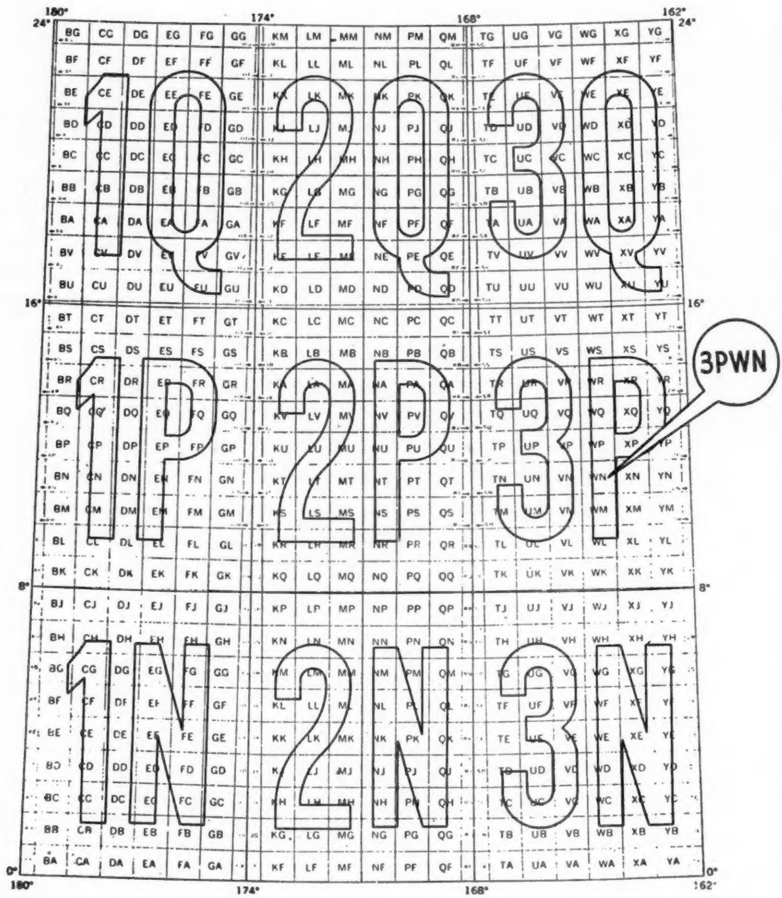


FIGURE 5

Within each UTM grid zone, a further breakdown is made into squares, each identified by a two letter designation. Thus in the example above, 3PWN identifies a specific segment of the earth's surface. This square is further subdivided, making it possible to pinpoint a single square meter within each grid zone.

it was directed to begin an adjustment of a network of first-order triangulation in the Central European Area, to be completed within two years.

This small nucleus of technical personnel was augmented until finally fifty geodetic engineers and mathematicians had been brought together. They made a thorough analysis of the German survey records for the preceding 140 years in order to select the highest quality astronomic stations, Laplace stations and bases. The "Laplace stations," incidentally, are surveyor's reference points in which astronomic observations are adjusted to terrain. The experts also selected the east-west and meridional arcs to be included in the adjustment.

The project was under administrative control of the Chief Engineer, United States Forces European Theater, to whom the Army Map Service transferred funds for the program. The adjustment of the Central European Area was completed in June 1947, and a final detailed report was submitted to Army Map Service. The area covered is approximately a million square kilometers. In the adjustment of the 714 first-order triangulation stations, the map makers employed 106 Laplace and 77 astronomic stations. Thus a geodetic datum was established which does not rest on any one initial point but is a condition of the entire area. All bases were reduced to sea level and to the international meter. The geodetic datum so established was called the Central European Datum, but now is generally called simply the European Datum.

In 1946, while the Central European adjustment was well under way, Army Map Service proposed that the adjustment be extended to include southwestern and also northern Europe. This project was carried out by the United States Coast and Geodetic Survey under a contract with Army Map Service. By August 1948, all major differences and objections had been resolved and the program was completed in June 1951. Thus there is now a mathematically consistent geodetic framework for the cartography of a whole continent, based on the international meter of length and on a single geodetic datum.

Having performed the adjustment of the first-order triangulation to the European datum, the next step was to complete a similar adjustment for about nine hundred thousand lower-order triangulation stations of Europe covering an area of some five million square kilometers. Through excellent co-operation by the countries concerned, the Army now has these lower-order triangulation stations on file. The data forms a solid basis

for the UTM system in Europe and northwest Africa.

All of this material, covering about two and a half million control stations, had to be converted from native coordinates to the UTM. This was accomplished by leasing a number of electrical business machines, supplemented by improved electronic computers. These computing machines were also used for calculating the sheet-corner data for the conversion of the thousands of maps of various scales to the new system.

The UTM Grid Conversion Project

The Universal Transverse Mercator Projection, Grid and Reference System was officially adopted by the United States War Department in 1947; somewhat later the Department of Defense approved it for United States joint military operations. Then Army Map Service began a move toward eventual acceptance by various countries of the world. Today armies of the allied nations have adopted it for all joint military operations.

Immediately after adoption of UTM by the Army, an all-out effort to implement the grid conversion project was begun by Army Map Service. In addition to the analysis and processing of masses of data, as already described, it was necessary to begin application of the new system to many thousands of maps of large and medium scale. This program has proceeded under considerable pressure for speed, due to the international situation.

The task of converting all of the large-scale maps covering Central and Western Europe began in November 1950 with the full co-operation of all participating European nations. This phase of the program involved more than ten thousand individual maps, of which Army Map Service was responsible for conversion and reproduction of almost eight thousand sheets, plus reproduction only of over four hundred others. Of the sheets for which Army Map Service was responsible more than a thousand required major cartographic revisions over and above the actual conversion of the grids. About thirteen hundred had never before been published.

In addition to printing the maps, it also was necessary to reproduce trigonometric lists covering the area which had been converted to the UTM grid. This meant that over fifteen hundred books, listing a total of more than four hundred and twenty thousand trigonometric stations, had to be produced in large quantities. Altogether, nearly half a million copies of these books have been printed.

Completion of the UTM grid conversion program marked

perhaps the largest single project in the history of military map making. That it was accomplished in the short space of fifteen months shows what can be done in a co-operative effort by friendly nations. Besides the efforts of Army Map Service, the project engaged practically the entire facilities of the military mapping agencies of Belgium, France, Great Britain, Italy and the Netherlands. In addition, mapping units of the British, French and United States occupation forces in Germany co-operated in the project.

As a result of adoption of the Universal Transverse Mercator grid, maps of strategic areas will be available for use without difficult computations and conversions in the field. Thus a long, arduous job, performed in record time, is contributing to the solidarity of Western Europe's defense effort.

The United States must not only have striking power, but it must also have staying power as well. While we strive to achieve a proper military posture, we should also remember that we must maintain our economic vitality. Strength alone is not enough. We must also have sufficient endurance to face successfully whatever the future has in store for us.

The Honorable Roger M. Kyes
Deputy Secretary of Defense

HARD FACTS FOR STRAIGHT THINKING

LIEUTENANT COMMANDER GEORGE DENNIS, JR.

THE SOLDIER was young and blond, with quick eyes in a thin face. He was a draftee from Ohio who had just been rotated back from Korea. He spoke with a flat, determined seriousness.

"Why," he asked, "don't they forget the fancy salesmanship? The sugar-coating. The inspirational stuff, all wrapped up nice and pretty. Why not just give us the straight story of how we fit into this thing, in simple a-b-c language, without making us think it has to be greased before we will swallow it?"

This is a good question for any of the military mind-power people who are concerned with developing the most effective devices for mass persuasion. It has particular impact for those in Information and Education who work with such elusive intangibles as patriotism and democracy in generating a message to inspire faith. And it has real meaning to commanders who must keep a sensitive finger on their information pipelines.

It points up one question now faced in building a workable citizenship information program, which is an effort to promote in the minds of our military people a rediscovery of the traditional purposes and principles of democracy. This program is designed to encourage a man to say honestly: "I know why I am in uniform and I am proud of the privilege to serve." The question is whether the trimmings we may use in our message will be considered wholly exaggerated—unnecessary frills that weaken the acceptance of our words.

It is more than the need for using shirt-sleeve language that the soldier was talking about. It is more than our exploitation of the proved ingredients that produce media which enjoy so-called reader impact and editorial influence. It is more than the care we exercise with publications not to kill the golden goose with exhortation and sermon. It is more than simply

LIEUTENANT COMMANDER GEORGE DENNIS, JR., USN, is Chief of Publications Branch, Office of Armed Forces Information and Education, Department of Defense.

building "sell" into a presentation, or the use of creative skill tempered by an almost intuitive understanding of what moves people to act.

Perhaps we should step back a few paces and look over a tough, competitive situation that requires us to re-examine our publications and other tools of information.

We are dealing with *people* and a *product* and we are armed with a thorough and understanding knowledge of both. We know our prospective purchasers and we know our product.

Some questions arise: How much appetite does our audience have for straightforward, undisguised information? Are we begging for the readers' attention? Have we gone on the defensive, and *has our audience sensed it,* thereby increasing its resistance? Is the sugar-coating turning sour?

We cannot shrug away the challenge with an off-the-cuff excuse that our target is "today's busy reader," an individual suffocated with printed words who reluctantly responds only to a sort of intellectual hot foot—an appeal wrapped in red, white and blue that has the Statue of Liberty as a backdrop. We cannot tackle the fellow who has the "What's in it for me?" attitude with the blatant offer to supply a magic transfusion of patriotism to dissipate his resistance. There is no short cut or magic formula that will work consistently.

We in Information and Education are faced with the cold, hard fact that virtually all of America's young, able-bodied men will wear a military uniform at one time or another in the future. We can accept the fact that our military strength requirements will demand that most of these people will be serving involuntarily. We can be assured that the information material we produce, and the impact of that material, will determine to a considerable extent the effectiveness of those individuals as servicemen and future citizens.

We know that telling the American serviceman what is expected of him, why he is being required to fight for his country, and what he can expect in battle is not new in our military history. We also know that today's serviceman will approach our material with the same inquisitiveness that he displays in probing for clues in a "whodunit."

Our job is to utilize our information publication channels with such effectiveness that the young soldier will respond to sound conclusions reached through a logical word process.

We want to avoid the alarming attitudes toward service which existed in some quarters in the immediate pre-Pearl Harbor

period. We want to utilize the citizenship phase of basic training to provide a healthier start for the individual's development during his military service. We want to instill such an abiding belief in freedom that he is aware that it is endangered and that he must fight for it. Moreover he must know what is required of him as an individual in that fight.

Our information materials must effectively carry out our military mission in the field of citizenship. They must tie in our message with the individual's everyday experiences on an integrated basis and not be presented as a separate package.

In addition to making our young short-term servicemen good combatants, we want to develop worthy citizens, picking up the ball, so to speak, if it has been dropped in the home, the church or the school. To do this, we must produce information materials employing good selling techniques.

Once the objective is understood, the Information and Education specialist must increase his awareness of the many ways in which information media produce mass action. He must determine which is the most effective approach—the clever, brain-twister language that bubbles with froth and sparkle, or the bromidic common-clay talk of the people.

Conscious of what the soldier said about our "greasing" the message with fancy trimmings, we must take our material apart, analyze the components, see how they are put together, find out what makes them tick. This is the search to inject vital ingredients that make up the structure of the presentation. We approach the task with the conviction that the story of Americanism, and our dreams of what it is, are worthy of being told simply and honestly, without the need for fancy footwork.

First we must obtain an audience. Even an effusive medicine man requires an audience. But in this respect we are fortunate. We have an audience. We can also safely assume that it is a hungry audience, hungry for facts. That is an important assumption. If we play our cards right it will keep us off the defensive—the very condition which the young, blond soldier was thinking about when he said we greased our product before we gave it to him to swallow.

We know that information is a potent weapon and that ours is strong because we can use truth to reflect our actions.

So we adhere strictly to truth. It has been said that the strategy of truth means that we say what we mean and in our actions prove that we mean what we say. We know, however, that truth is not necessarily the sole basis for acceptance or rejection of

statements. We also know that we cannot rely on words only to change attitudes. Words by themselves are not imbued with magic power.

We keep hammering at one objective—to create reader confidence that we have something worthwhile to say and to establish beyond doubt that we are saying it in a simple, chatty way. We pack every square inch of space with sincerity. This is not a case of trying to sell hair tonic that will also wash your car and cure warts. Rather, we help the reader to identify himself as the protagonist. We carefully avoid using anything that might make him say: "They have got to wave the flag a little to make me perk up and believe this."

We concentrate on placing the burden of belief on the reader. We want him to associate the issue with his own immediate need. We want him to think: "I will respond because *they had enough confidence in me* to give me the facts *without* the sugar-coating."

Then we stop.

We stop because we do not want to strangle the golden goose. We have had our say and we can begin to devise ways of approaching the young, blond soldier on another issue, another question which he wants answered with simple, hard facts.

Ours is an Army that looks to the resourcefulness and brains of the individual American soldier to counter the threat of a potential enemy whose great advantage lies in abundant manpower and a ruthless control over that manpower. Consequently increasing the efficiency of our men and women in uniform and the civilians who make up the military establishment is essential. We must support our combat soldiers with superior tools and supplies of war so that they can offset the manpower of a potential enemy.

The Honorable Robert T. Stevens
Secretary of the Army

U. S. Navy Photograph

ADMIRAL ARTHUR W. RADFORD
Chairman, Joint Chiefs of Staff

ADMIRAL ARTHUR W. RADFORD

ADMIRAL ARTHUR W. RADFORD, USN, became an ensign in the Navy upon graduation from the United States Naval Academy in 1916. During World War I he served with the Atlantic Fleet aboard the USS *South Carolina* and continued on sea duty until 1920.

After completing flight training at Naval Air Station, Pensacola, Florida, he was assigned to the Flight Division of the newly established Bureau of Aeronautics of the Navy Department from 1921 to 1923. He served again with the Bureau of Aeronautics from 1932 to 1935.

Duty with aviation units of the USS *Aroostook, Colorado, Pennsylvania* and *Saratoga* was followed by command of the Naval Air Station at Seattle, Washington, from 1937 until 1940, and then as Executive Officer of the aircraft carrier *Yorktown*. From 1941 to 1943 he was Commander of the Naval Air Station at Trinidad, British West Indies. In 1943, as Director of Aviation Training, Bureau of Aeronautics, he was influential in organizing the wartime expansion of the naval aviation arm.

Admiral Radford commanded a Carrier Task Group in action against Japanese forces prior to and during the landing operations on Baker, Makin and Tarawa Islands. In December 1943 he became Chief of Staff and Aide to the Commander Aircraft Pacific.

He returned to the United States in the spring of 1944 for duty as Assistant Deputy Chief of Naval Operations (Air). He rejoined the Pacific Fleet as a Carrier Task Group Commander and directed naval air action against Tokyo, Iwo Jima, Kyushu and in support operations at Okinawa.

After duty in the Navy Department as Deputy Chief of Naval Operations (Air) he served with the Atlantic Command as Commander, Second Task Fleet, and in 1948 returned to the Navy Department as Vice Chief of Naval Operations. In April 1949 he was named Commander in Chief, Pacific, Commander in Chief, Pacific Fleet, and High Commissioner of the Trust Territory of the Pacific Islands.

U. S. Army Photograph

GENERAL MATTHEW B. RIDGWAY
Chief of Staff, United States Army

GENERAL MATTHEW B. RIDGWAY

GENERAL MATTHEW B. RIDGWAY, USA, entered the Regular Army upon graduation from the United States Military Academy in 1917. After duty with the 3d Infantry, he returned to West Point as instructor and manager of athletics. He served overseas with the 15th Infantry in Tientsin, China, in 1925; with the American Electoral Commission in Nicaragua in 1927-29; with the 33d Infantry at Fort Clayton, Canal Zone, in 1930-32; and as technical adviser to the Governor General of the Philippine Islands, Theodore Roosevelt, Jr., in 1932.

General Ridgway was graduated from The Infantry School in 1924, from the Command and General Staff School in 1935, and from the Army War College in 1937. He performed tours of duty as Assistant Chief of Staff, G3, at Headquarters, Second and Fourth Armies and the former Sixth Corps Area.

From 1939 to 1942, he was assigned to the War Plans Division of the War Department General Staff. In 1942 he became commanding general, 82d Airborne Division, and the following year led his unit in the airborne assault on Sicily, then through the Italian campaign. In June 1944 he parachuted with leading elements of the division into Normandy. He commanded the XVIII Airborne Corps from the Ardennes campaign to its junction with Russian forces on the Baltic.

Among his postwar assignments, he commanded the Mediterranean Theater of Operations and served as Deputy Supreme Allied Commander, Mediterranean. He served on the Military Staff Committee of the United Nations and was Chairman of the Inter-American Defense Board. After duty as Commander in Chief, Caribbean Command, he was assigned to the Pentagon in 1949 as Deputy Chief of Staff for Administration.

On 23 December 1950, General Ridgway assumed command of the Eighth Army in Korea. The following April he was appointed Commander of the United Nations Command in the Far East, Commander in Chief of the Far East Command, and Supreme Commander for the Allied Powers in Japan.

General Ridgway succeeded General of the Army Dwight D. Eisenhower in May 1952 as Supreme Commander, Allied Powers, Europe, with headquarters at Fontainebleau, France.

U. S. Navy Photograph

ADMIRAL ROBERT B. CARNEY
Chief of Naval Operations

ADMIRAL ROBERT B. CARNEY

ADMIRAL ROBERT B. CARNEY, USN, was commissioned ensign upon graduation from the United States Naval Academy in 1916. Assigned to duty with the U. S. Atlantic Fleet in World War I, he engaged in anti-submarine operations as Gunnery and Torpedo Officer.

Following extensive sea duty, he became an instructor in navigation at the Division of Fleet Training, Office of the Chief of Naval Operations from 1928 to 1930 and was War Plans Officer of the Naval Gun Factory and the Washington Navy Yard and District from 1933 to 1935.

Admiral Carney was assigned to the Office of the Assistant Secretary of the Navy from 1938 to 1940. There he assisted in the co-ordination of the Navy's small craft program, including design and construction of motor torpedo boats and subchasers, and in planning for mobilization of privately owned craft and their operators in an emergency.

After duty as Executive Officer of the USS *California* in 1940-41, he became Chief of Staff of Task Force 24. He served as Chief of Staff and Aide to the Commander, South Pacific Force, from 1943 to 1945, after which he transferred to the staff of Commander, Third Fleet, in the same capacity. He conceived and correlated the offensive operations carried out in the Solomon Islands and Bismarck Archipelago Areas, and planned combat operations in which Task Forces of the Third Fleet engaged capital ships of the Japanese fleet in the Battle for Leyte Gulf.

In 1946 he became Deputy Chief of Naval Operations (Logistics) in the Navy Department. In March 1950 he took command of the Second Fleet and in August of that year was designated Commander in Chief, U. S. Naval Forces, Eastern Atlantic and Mediterranean.

He went to Supreme Headquarters, Allied Powers Europe in May 1952 as Commander in Chief, Allied Forces, Southern Europe and Commander, Allied Naval Forces, Southern Europe, with headquarters in Naples, Italy.

U. S. Air Force Photograph

GENERAL NATHAN F. TWINING
Chief of Staff, United States Air Force

GENERAL NATHAN F. TWINING

GENERAL NATHAN F. TWINING, USAF, was called into Federal service with the Oregon National Guard in 1916 and was commissioned in the Regular Army as second lieutenant of Infantry upon graduation from the United States Military Academy in 1918. After attending The Infantry School in 1920, he was stationed at Fort Benning, Georgia, Camp Travis, Texas, Fort Logan, Colorado, and Fort Sam Houston, Texas.

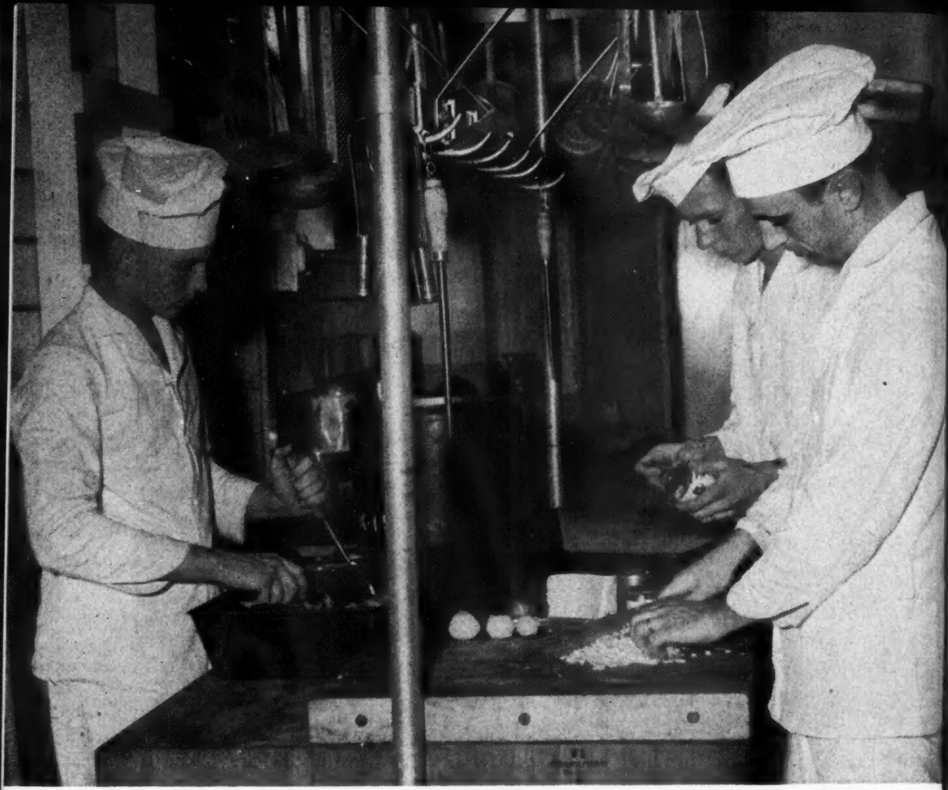
In 1924 he completed primary flying school at Brooks Field, Texas, and advanced training at Kelly Field, Texas, then served as flying instructor. He transferred to the Air Service in 1926 and was assigned to aviation duties at March Field, California, Schofield Barracks, Hawaii, Fort Crockett, Texas, and Barksdale Field, Louisiana. He was graduated from the Air Corps Tactical School at Maxwell Field, Alabama, in 1936 and from the Command and General Staff School at Fort Leavenworth, Kansas, in 1937.

In 1940 General Twining was assigned to duty in the Office of the Chief of the Air Corps where he filled several positions. Shortly after the attack on Pearl Harbor he was named Director of War Organization and Movements in the Office of the Chief of Staff of the Army Air Forces.

He went overseas in 1942 as Chief of Staff of Allied Forces in the South Pacific and subsequently was named commanding general of the 13th Air Force in that theater. In July 1943 he was placed in tactical control of all Army, Navy, Marine Corps and Allied air forces in the South Pacific area. In this capacity he directed air movements on Treasury Island and also on Bougainville Island.

Later that year he assumed command of the 15th Air Force in Italy and of the Mediterranean Allied Strategic Air Forces as well. Returning to the Far East in July 1945, he commanded the 20th Air Force during the final stages of the atomic air war against Japan.

General Twining's postwar assignments include duty as Commander, Air Materiel Command, Commander in Chief, Alaskan Command, and Vice Chief of Staff of the Air Force.



FEEDING THE ARMY

Colonel Joseph S. Kujawski

MOST SOLDIERS experience at least three happy events every day—breakfast, dinner and supper. Heaped high on plates, trays and mess kits are fresh vegetables and fruit, tender meats, generous pieces of pie and other appetizing foods which make the American soldier the world's best fed fighting man.

Some in the military service take this condition for granted, forgetting that it requires lengthy and extensive planning and effort on the part of the Quartermaster Corps to keep them well fed. In the days of the Revolutionary War, for example, Army fare was monotonous and often unpalatable. There were no cooks or bakers as such. The ordinary soldier had to prepare

COLONEL JOSEPH S. KUJAWSKI, Quartermaster Corps, is Chief of the Food Service Division, Office of the Quartermaster General, Department of the Army.

his food the best way he knew how. After receiving his basic ration of beef, flour, milk, peas and rice, it was up to him to exercise his culinary skill over a campfire or crude oven of dirt or rocks.

Feeding today's Army of more than 1,500,000 begins in Washington, D.C., in the Menu Planning Branch, Food Service Division, Office of the Quartermaster General. Menus and ration scales prepared here are the Army's guide for serving three tasty, well-balanced meals a day to its soldiers all over the world.

Based on ingredients which the Army expects to consume during the forthcoming year, an annual Food Pattern is drawn up twelve months in advance. Master menus, spelling out the recommended day-by-day fare, are prepared six to seven months in advance. Local menu boards, using these as a guide, may make substitutions and additions, catering to the eating habits of troops in various parts of the world. As a general principle to insure well balanced meals, the Menu Planning Branch advises the use of "the basic seven"—cereals, proteins (meat, fish, eggs), leafy green or yellow vegetables, dairy products, citrus fruits, and other fruits and vegetables.

But besides considering the nutritional value of its meals, the Quartermaster Corps tries to make them acceptable to its diners. One of the major "musts" in the job of choosing popular foods is inspection and research. This means visits to Army dining halls to check on the cooking and serving of food. It also involves talks with soldiers about their likes and dislikes, reports from liaison officers and numerous scientific surveys. The Menu Planning Branch studies the tastes of the troops and their reaction to various dishes. Preference ratings obtained from food surveys, for example, show that a meal offering hot biscuits, chopped salad, roast turkey, fresh milk and banana cream pie would delight most soldiers. On the other hand, a meal offering onion soup, grilled liver with onions, cauliflower with cheese sauce, chilled asparagus salad and stewed apricots might hit a new low in Army gastronomic appeal.

After years of food research, the Quartermaster Corps now has several standard rations. Field Ration A, first used in World War II, is served at all installations in this country and at oversea posts where refrigeration is available. Consisting of some three hundred items, it includes fresh foods similar to those sold in any local grocery store.

The B Ration, also developed during World War II, is designed for large group feedings in combat zones where no

refrigeration is available. Many of its 118 items are similar to those of the A Ration, except that they are canned. They include canned meats, cereals and cereal products, canned milk products, canned and dehydrated fruits and vegetables, powdered milk and powdered eggs.

Shortly after the Korean War began, the B Ration was improved by eliminating hash, stew and other chopped meats. These were replaced with eleven different kinds of better-tasting solid meats and fish, such as bacon, corned beef, beef and gravy, boned chicken or boned turkey, ham chunks, luncheon meats, pork and gravy, vienna sausage, pork sausage links, salmon and tuna fish.

One familiar item, dehydrated or powdered eggs, has been greatly improved. The new powdered eggs are better tasting and they retain their palatability longer. Other dehydrated foods which have been improved in taste and quality include apples, cranberries, milk, onions, potatoes and chicken noodle soup.

To accompany the improved B Ration, the Quartermaster Corps issues menus covering 15-day periods. High in calories, these menus furnish approximately 4200 calories per man per day, 600 more than the number prescribed by The Army Surgeon General for an active soldier. Intended to provide additional heat and energy needed by troops under the high tensions of combat, the menus can be revised to meet changing battle conditions and climates.

In Korea most soldiers are eating at least two hot meals a day, either the A or B Ration type. To keep meals hot, several systems are used. In some cases the field kitchen is set up in a tent just behind the front lines. There the meals are prepared on portable gasoline ranges, and troops able to leave their position go to the serving line in small groups. Sometimes the kitchen may be a 2½-ton truck outfitted with field ranges and towing additional equipment in a trailer. This serves best when troops are on the move, as the food can be cooked while the soldiers are en route. When heavy action prevents the troops from visiting the field kitchen, the food is placed in bulk in insulated containers and taken to the front lines by truck or jeep. The containers keep the food warm as long as twelve hours even in zero weather.

In situations where soldiers cannot be reached by the field kitchens, they are given packaged meals to take with them. These concentrated, high-energy food packages contain nutritious items such as cereal, meat, vegetables, fruit, bread, soluble

coffee and cocoa. They range in caloric content from 900 to 4500 calories, in weight from $1\frac{1}{4}$ to $6\frac{1}{2}$ pounds.

One of the most widely used of these packaged foods is the C Ration containing canned, pre-cooked meat and fruit, jam, crackers, cookies, coffee and sugar. It can be served either cold or hot, and its six different menus offer the best balanced meals obtainable in cans. A sample menu includes chicken and vegetables, beans with frankfurter chunks, ground meat and spaghetti, cherries and crackers.

When small groups of men are on patrol or outpost duty, they may use the Five-in-One Ration. Packaged in a 28-pound box which can be tossed into a jeep, it is enough for five men

Developed by the Quartermaster Corps, this portable stove contains all gear necessary to prepare hot food for 20 to 30 persons. U. S. Army Photograph

for one day. The ration is packed in ten different combinations of canned meat, canned bread or biscuits, three kinds of pudding, five kinds of jam, six different vegetables, sugar, milk, coffee or cocoa, cheese and butter spread, candy and fruits.

Similar to the Five-in-One is the assault food package issued for use during amphibious or airborne attacks. Its eight different menus offer enough canned meats, cookies, crackers, soluble coffee, sugar, candy and chewing gum to sustain one man for thirty hours. Meats may be beef and pork loaf, boned chicken, ham and eggs, hamburgers, pork and beans or sausage.

This field kitchen is set up amid the ruins of a village not far from the 38th Parallel in Korea. U. S. Army Photograph

For emergency use in the Arctic regions a smaller food kit is issued containing the minimum amount of food required by one man for one day. It takes the form of concentrated and compressed cereal, fruit and chocolate, soluble tea and coffee, bouillon powder and water purification tablets.

Still another food packet—containing candy, chewing gum, sugar cubes, soluble coffee, soluble tea, water purification tablets and vitamins—is designed for survival in the tropics. Finally, there is a package of food tablets prepared for survivors of sea or air disasters.

While the packaged foods have an important place in the Army's diet, the vast majority of soldiers still dine in a mess hall of one kind or another. Here the preparation of tasty meals depends on the skill of Army cooks and bakers. To insure top quality, the Quartermaster Corps' Food Service School at Fort Lee, Virginia, graduates 2500 enlisted men and women each year. Trained in one or more phases of taste-tempting cookery, they are also credited to a large extent for the record savings in food costs.

Food Service School students must master the art of preparing food economically without sacrificing its vitamin content or taste. Meat cutters and cooks undergo eight weeks of schooling. Student meat cutters learn how to cut sides of beef, lamb, pork and veal which can be sent directly to mess halls for immediate roasting or grilling. Trainee cooks study basic principles of nutrition, menu planning, storage and handling of food, use of leftovers, the importance of balanced meals and related subjects. Student bakers, taking an eleven-week course, make breads, pies, cakes and cookies. Their daily output of three thousand pounds of bread is consumed at Fort Lee.

Officer graduates of the Food Service School are sent to Army installations in the zone of interior and abroad as advisers to the local commanders. Other food service specialists, ranging from sergeant to master sergeant, are taught how to conduct on-the-job training so that they may instruct cooks and bakers at their home stations.

Thousands of additional personnel, meanwhile, are trained in food service schools operated in the six Army Areas. Courses for mess officers and mess stewards, for example, teach students to estimate the amount and kinds of food needed to serve both small and large units, thereby eliminating waste.

Without its vast food service training program, the Army could scarcely operate what amounts to the world's largest

While a machine gunner stands guard, Army cooks prepare dinner for United Nations troops in Korea. **U. S. Army Photograph**

This field kitchen which served troops in Exercise Southern Pine is typical of those used during maneuvers. **U. S. Army Photograph**

restaurant chain. To help supply its mess hall in the Far East, the Army maintains a unique truck garden in Japan where native farmhands work under supervision of soldier technicians. Hydroponic farming, or the cultivation of vegetables in chemical solutions and sand or gravel, was developed by the Army because of the harmful soil bacteria prevalent in that part of the world. Although soil farming is also used under controlled conditions, the hydroponic farms continue as an important source of supply for the Tokyo Quartermaster Depot.

Ranging from lettuce and tomatoes to egg plant, the hydroponic farm vegetables not only are equal in quality to those grown by ordinary methods, but they actually have many advantages. First, because the temperature of the chemically treated water fed to the plants can be controlled, the vegetables grow faster. Second, since the gravel beds can be sterilized, the control of plant diseases is easier and more successful.

Finally, the operation of these gardens provides a varied selection of highly perishable vegetables which otherwise could not withstand shipment half way around the world from the United States. Millions of pounds of vegetables have been grown each year since the farms began operation in 1946. In 1952 the hydroponic farms alone produced eight million pounds of vegetables. The soil farms were a close runner-up with seven million pounds.

Tons of these vegetables arrive in Pusan every week for the men at the front. With a priority second only to hospital trains and emergency ammunition shipments, the produce travels in iced box cars to division supply centers. Personnel of the Army Veterinary Corps check on sanitation and refrigeration conditions along the way.

All of this planning and effort to insure top quality food for the Army is a far cry from the days of hard tack and beans. In those days, a soldier could not expect too much at mealtime. But look at him now. His mess kit is loaded down with wholesome energy-producing food, tastefully prepared by experts who realize that morale is made up of many things—especially three good meals a day.

ARMY SURGICAL HOSPITALS AT WORK IN KOREA

LIEUTENANT WALTER MARSH

ALTHOUGH THE KOREAN WAR has been widely regarded by military leaders as a limited operation with many special aspects, certain innovations in field medical service proven there have already gained acceptance as current doctrine. Along with helicopter evacuation, the psychiatric detachment and the preventive medicine company, one of the outstanding medical developments has been the Mobile Army Surgical Hospital.

During World War II, the critically wounded received their initial surgical treatment at an installation working with, or adjacent to, the division clearing station. In the Pacific, this was often a Portable Surgical Hospital that could actually be carried on the backs of its four officers and sixty enlisted men. In Europe, it was a platoon of a Field Hospital, reinforced by surgical teams. Both units have now been supplanted by the Surgical Hospital.*

The Table of Organization and Equipment for the Mobile Army Surgical Hospital—or MASH as it was ungraciously abbreviated—first appeared in 1948. Early this year, in February 1953, Eighth Army Mobile Army Surgical Hospitals were reorganized under the newly revised T/O&E and redesignated as Surgical Hospital (Mobile Army).

Originally organized as a mobile, sixty-bed hospital, its mission was to receive non-transportable patients from division clearing stations and prepare them for evacuation. Assignment was to Army with allocation of one per combat division, but

*The Portable Surgical Hospital which was designed to supplement the organic medical service of a division or task force, has been discontinued. However, the Field Hospital continues in existence with the mission of providing hopitalization to troops in the communications zone where temporary hospital facilities are required. The use of a Field Hospital to support combat divisions was a wartime expedient and did not alter the mission for which this hospital was designed.

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exigencies of the Korean War frequently led to modifications of this concept.

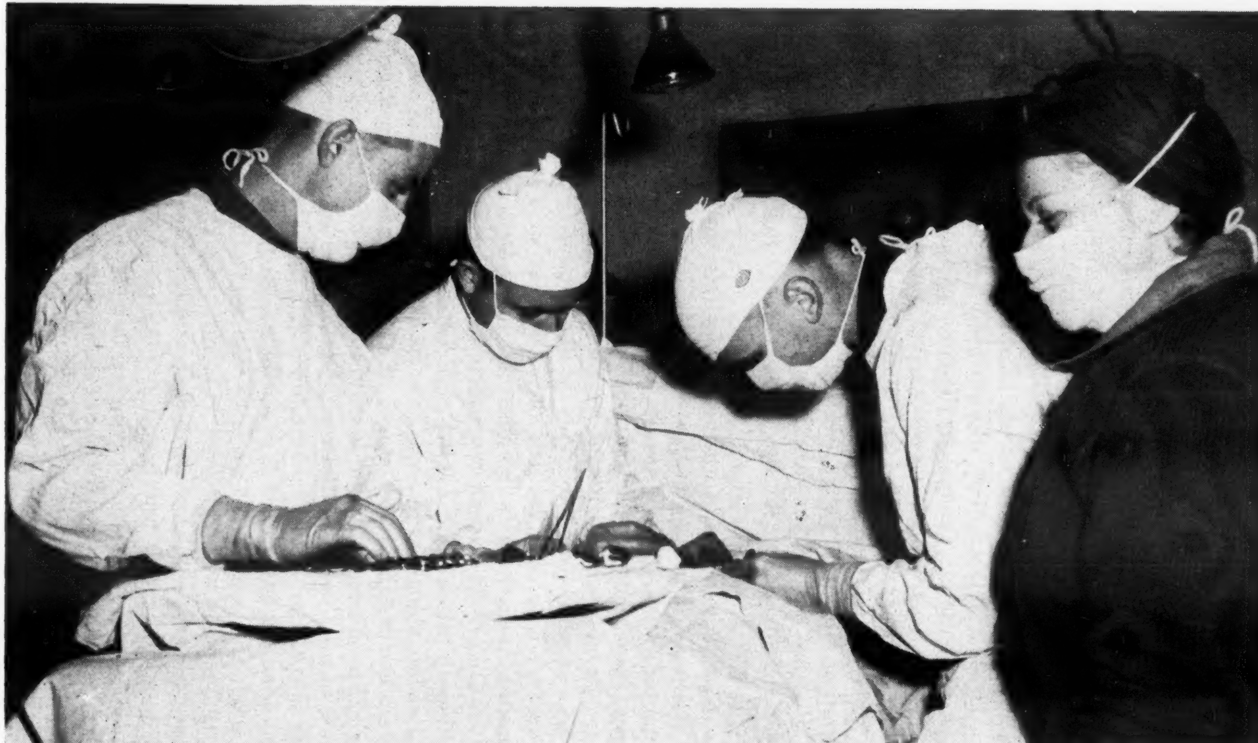
By mid-1953 there were five United States Surgical Hospitals in direct support of tactical operations in Korea plus one unit tailor-made as a hemorrhagic fever treatment and research center. The five front-line hospitals were supplemented by a Norwegian mobile unit. Six similar Republic of Korea Army hospitals operated in support of ROK divisions.

During the first month of the Korean War, three Surgical Hospitals—the 8055th, 8063d and 8076th—arrived in Korea. Almost immediately changes in the concept and employment of the hospital became necessary. The staff and equipment proved insufficient to care for the large numbers of casualties arriving hourly. This condition was aggravated by the fact that the Evacuation Hospitals themselves had become practically immobile. Because of the poor conditions of the roads, these units had to remain in one of the few areas adequately served by rail transportation.

As a consequence, the Surgical Hospitals were transformed into half-scale Evacuation Hospitals. The establishments were augmented until the hospitals had two hundred beds and received non-transportable surgical cases plus practically any other type of case transferred by the division medical service. Aid was also furnished to many of the non-divisional units in the area and holding facilities were increased. The expanded personnel strength included fourteen physicians, four Medical Service Corps officers and seventeen nurses.

Although the original T/O&E called for one Surgical Hospital per division, that idea has rarely been attainable in the Korean theater. During the latter stages of the stalemated war it was not entirely necessary. Almost invariably each hospital has supported more than one division and in some cases almost an entire corps. It should be noted, however, that the employment of any medical unit depends upon the existing tactical situation. Although the use described here was dictated by the special situation encountered in Korea, this in no way changes the basic concept for the employment of the Surgical Hospital.

Originally, it was felt that the hospital should be located adjacent to the division clearing station. However, during the Korean conflict hospitals without exception have been located further to the rear, usually ten to twenty miles behind the lines. Several factors contributed to this situation. First, since the hospitals were generally serving more than one division, it was



A technician, two surgeons and an Army nurse—members of a Mobile Army Surgical Hospital unit—provide skilled surgical aid to a soldier wounded in Korea.

U. S. Army Photograph

necessary to place them further back for accessibility to all using units. Second, helicopter transportation decreased the amount of time needed to reach the hospital. A third factor was the difficulty of finding sites with sufficient area and hard standing. Because of the terrain problem presented by Korea's mountains and rice paddies, it was not always possible to locate an installation in what was tactically the most desirable area.

Surgical Hospitals are now responsible for virtually all the major surgery required by combat casualties. The clearing company is restricted to minor surgery performed on patients who can be held in the division area until return to duty.

Naturally the tactical situation vitally affects the holding of patients in forward areas. Since the advent of helicopter evacuation, the clearing company is frequently by-passed completely by seriously wounded patients. Instead, they are moved directly from the forward aid stations to the hospitals where excellent surgical facilities are available. This also eliminates a tiring ambulance ride over rough, dusty roads.

During the recent stages of the war, many people questioned the mobility of the Surgical Hospital. While it is true that only a few moves were made during the past year, actually all units are kept alert with drills and practice moves.

The semi-permanent appearance of most of the hospitals is indeed deceiving. Although now largely housed in prefabricated buildings, the units are perhaps more mobile now than when under canvas, since their assigned tentage is constantly packed and ready to be moved to the next location. Buildings erected at the hospital site would be turned over to other units or if time permitted, dismantled and moved forward. The pre-fabs have already more than paid for themselves in increased efficiency, in comfort for both patients and hospital personnel and in conservation of expensive tentage.

Despite the present permanent appearing installations, the units demonstrated during the early phases of the war that they could move readily. Records of the three Surgical Hospitals in Korea during 1950 show that all three entered the theater during July and by the end of that year had made a total of forty moves, the longest stay in one place by any unit being just over two months.

In 1952, it was apparent that the tactical situation warranted a return to the sixty-bed T/O&E. By early 1953 the transition was complete. Since the change, grave emergencies were handled by lateral evacuation and rapid transfer of patients to

the Evacuation Hospital. During the battle for Old Baldy, for instance, eighty-two casualties were brought from division areas direct to the 121st Evacuation Hospital, thus relieving the pressure on the Surgical Hospitals in the area. Patients were treated in the Evacuation Hospital a short time after leaving the front.

Changing concepts of evacuation have probably modified medical service during the Korean War more than any other single factor. Each Surgical Hospital now has a helicopter detachment adjacent to the unit, plus at least one ambulance platoon. These helicopter detachments are under the operational control of the field Army surgeons and are based at the hospitals for convenience.

At one time, surgical teams were organized within each hospital for dispatch to other hospitals in case of an emergency; but emergency evacuation of the wounded succeeded so well that the teams are now felt to be unnecessary.

Another feature of the medical service in Korea has been the Neurosurgical Detachment—a small, specially equipped and staffed unit which is fully integrated with a Surgical Hospital. All cases involving head injuries are transferred there by helicopter for treatment.

It is doubtful that any other medical unit has ever caught the imagination of the public and the American fighting man as completely as has the Surgical Hospital. Even those with no special knowledge of, or interest in, the Medical Service Corps are fascinated by its drama. The arrival of a helicopter with a wounded patient, the rush of litter bearers, the cool efficiency of the receiving ward, and the modern operating room so near the front, bring into focus a truly dramatic picture of lifesaving effort. Since the Korean action proved its worth, the Surgical Hospital has indeed become an integral element in the operation of a field army.

MERCY IS THEIR MISSION

REAR ADMIRAL LAMONT PUGH

THERE IS ONE SHIP in the fleet which every fighting man hopes he will not have to see at close range. Hovering on the horizon, her sides and decks gleaming white except for a horizontal green stripes above the water line and red crosses on her hull, stack and landing deck, she is the hospital ship.

Still, the sight of her is a comfort, for she denotes to able-bodied and wounded alike that all the aid medical science can give is standing by.

As vessels of mercy and comfort, Navy hospital ships have a long, proud history. For a century and a half, from the shores of Tripoli to Korea, they have been standing by to care for the sick and wounded.

The first U. S. Navy hospital ship, the USS *Intrepid*, so designated by her admiral, Commodore Edward Preble, in 1804, had previously seen service as a gunboat for the French and as a pirateer under the Bashaw of Tripoli. Another early hospital ship, the *Jamestown*, made a mercy trip with food to relieve a famine in Ireland. Years later she was still serving off Panama during a yellow fever epidemic.

In the Civil War many kinds of ships were used to aid the wounded. River steamers, liners and sailing vessels operated up and down the Atlantic, the Gulf of Mexico and in the waters of the Potomac, James, Ohio, Tennessee, Cumberland, Mississippi, Arkansas, Yazoo and Red Rivers. The most famous was the USS *Red Rover*. Captured from the Confederates, this wood-burning side-wheeler was outfitted with the best that medical men could provide in those days. "She is decided to be the most complete thing of the kind that ever floated," the Navy Quartermaster wrote. "She has bathrooms, laundry, elevator, amputating room, nine water closets, gauze blinds to keep out the cinders, two kitchens and a regular corps of nurses." After making her first run down the Mississippi below Memphis to pick up survivors from an explosion aboard another Union ship, the *Red Rover* was in the thick of the fighting until the end of the

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As patients are brought aboard a hospital ship by litter bearers, they are checked in by a Navy nurse. **U. S. Navy Photograph**

campaign in the west. Whether she actually used her 32-pounder cannon is not known, but her log shows she took part in two engagements.

The fact that she carried a weapon points up a situation which today would be considered barbaric. Hospital ships in those days were expected to defend themselves if necessary. The account of one ship, the *S. R. Spaulding,* implies the ever-present danger. In July 1862, this ship was ordered up the James River, a voyage which was to bring her close to Confederate gun batteries. Her captain was told there would be no danger as long as she raised a yellow flag. However, she had no yellow flag and, instead, had to hoist the red flag of the Sanitary Commission, an early prototype of the Red Cross. As she drew near to the enemy batteries, the skipper ordered a barrier of thick mattresses erected inside the wheelhouse and the ship's cannon pointed at the bank. Apparently nothing happened, but from all accounts, the ship's crew expected the worst.

Armament continued for several years after the Civil War. Another famous hospital ship, the *Pawnee,* carried two 24-pound howitzers, thirty .50-caliber carbines, thirty .50-caliber pistols and thirty cutlasses. Finally, in 1882, at the insistence of Clara Barton, the United States signed the Geneva Red Cross Convention, making hospital ships protected vessels. The USS *Solace,* commissioned in 1898 in time to bring wounded Spanish prisoners of war to Norfolk and pick up many victims of yellow fever, was the first American hospital ship to fly the International Red Cross flag.

Tradition, meanwhile, endowed the hospital ship with the nickname "White Lily." The *Relief,* famous in the 1920s and 1930s with the fleet, was well known by that name. Two others, the *Mercy* and the *Comfort,* were similarly dubbed.

The *Solace,* commissioned in 1941, more than proved the worth of her name at Pearl Harbor. Within a few minutes after the Japanese attack, her doctors and corpsmen were saving lives. For her gallant rescue work, she received a field citation from Fleet Admiral (then Rear Admiral) Chester W. Nimitz, but her job had just begun. During the next several years she cruised the Pacific and evacuated thousands of sick and wounded servicemen. In 1943 she cruised 37,000 miles to pick up 4200 patients.

In the bitterness of the Pacific fighting, the enemy sometimes ignored the protective insignia of the Red Cross. On 28 April 1945, about fifty miles south of Okinawa, a Japanese *kamikaze* pilot crashed his plane into the hospital ship *Comfort,*

seriously injuring 33 persons, killing 29 and leaving 100 missing.

It was during World War II that the modern hospital ship was designed and built from keel to stack as a floating hospital. Six of them, the USS *Haven, Tranquility, Benevolence, Repose, Consolation* and *Sanctuary*, came down the ways on the East Coast, the culmination of years of experience and painstaking planning to produce the finest of their class afloat.

Known as the *Haven* class, they were built to answer a desperate need during the Pacific fighting. "Fully 98 percent of all casualties brought aboard our hospital ships are saved," Admiral William F. Halsey wrote in 1945. "But men are dying because there are not enough of these ships in the Pacific. The fighting gets tougher all the time as we approach the Japs' front yard and our casualties are mounting. More hospital ships are desperately needed to handle the increasing number of wounded."

When they were launched, their capacity exceeded by several hundred beds anything previously used as a hospital ship. Each accommodates 802 patients, and if the need arises, the number of beds can be expanded to 1000. Each ship has seven decks, is 520 feet long, displaces 15,000 tons and has a cruising radius of 12,000 miles.

Ships of the *Haven* class are designed to handle a large number of casualties in a short period of time. Turbines, single stack and machinery are located aft. All sections of the medical facilities in the forward compartments may be reached through continuous corridors, an important traffic factor in times of heavy action. The medical section is not even broken by the customary cargo trunks dropping from the well decks to the hold. When casualties start coming aboard, they are brought down the forward elevator or ladders, taken directly to the anesthesia room and across the lobby to one of the operating rooms. The surgical suite, accessible from all decks by means of two elevators and two sets of ladders, is located on the second deck, at the metacenter of the ship where pitch and roll are at a minimum. The elevators are large enough to carry a standard litter and two or three attendants.

Much has been provided for the comfort of the patients. Quarters for medical personnel are located below the water-line, leaving the upper decks for wards and outside recreation areas. In addition, the ships are air conditioned throughout. Each ward and compartment has its individual air-conditioning thermostat, and the ventilation is on a separate fan system so that if the cooling apparatus breaks down, the ventilation will be main-

Helicopters help save many lives by transporting the wounded to hospital ships without delay. **U. S. Navy Photograph**

tained. Bunks have individual reading lamps and a five channel radio connection within arm's reach.

The employment of a hospital ship in an amphibious operation is typified by the action aboard the USS *Samaritan* after it arrived at Iwo Jima on D-day plus 1 during World War II. Shortly after the ship dropped anchor, the first casualties arrived by landing craft and amphibious trucks. In some cases the patients were brought aboard only thirty minutes after being hit. A medical officer on the after-well deck determined the extent of each man's wounds and assigned him to the proper ward. As conditions on the beach made it possible to give only emergency first aid, many of the wounded had nothing more than battle dressings. Those with fractures arrived with splints improvised from rifles, tree branches or boards torn from crates. These made up the greatest number of casualties, while the next most common types were chest, abdominal and head injuries.

To prevent excessive movement of the patients, as many as possible received X-rays before being taken to the wards. There

they were cut out of their clothing and checked for hemorrhages. Many were in shock and had to be given plasma and kept well covered with blankets.

Emergency treatment was administered and the wounded were made as comfortable as possible. Where the individual's condition permitted, he was given a bath to get rid of Iwo Jima's clinging volcanic ash.

Those who were bleeding badly had a pressure bandage applied and were taken to surgery as soon as their condition allowed. In abdominal cases it was necessary to operate early, preferably within six hours, as chances of survival diminish rapidly after that time. There were three operating rooms, one for orthopedic surgery, one for abdominal and chest cases, and a third for ear, eye, nose and throat work. But even though the ship was within range of the fighting, the wounded received treatment comparable to that in a hospital at home. Skilled medical and surgical care, facilities for therapy and special diets (including fruit juices and ice cream) speeded their recovery as the *Samaritan* steamed toward the United States.

Navy hospital ships were early in action in Korean waters. After a hurried trip from the East Coast via the Panama Canal, the USS *Consolation* arrived in Pusan harbor on 16 August 1950. A month later it was supporting the landing of the First Marine Division at Inchon harbor. While two other ships, the *Repose* and the *Haven*, were taking up their duties in Korean waters, the *Consolation* began serving as a base hospital afloat.

This followed a unique decision to leave the hospital ships in war ports for considerable lengths of time, where patients could be received, treated and disposed of either by return to duty or by evacuation by other means. Whenever the ships visited ports in Japan for upkeep and overhaul, they of course took some patients as evacuees. Generally, however, the policy of utilizing the ships as dockside hospitals has been followed and has proved conspicuously successful.

Up to the end of September 1952, admissions to the three United States Navy hospital ships in Korea totaled 40,662*. About 35 percent of these were battle casualties and the rest were the result of accidents behind the lines. While the record of the number of out-patients treated is not available, it is estimated that this total at least equals that of the admissions.

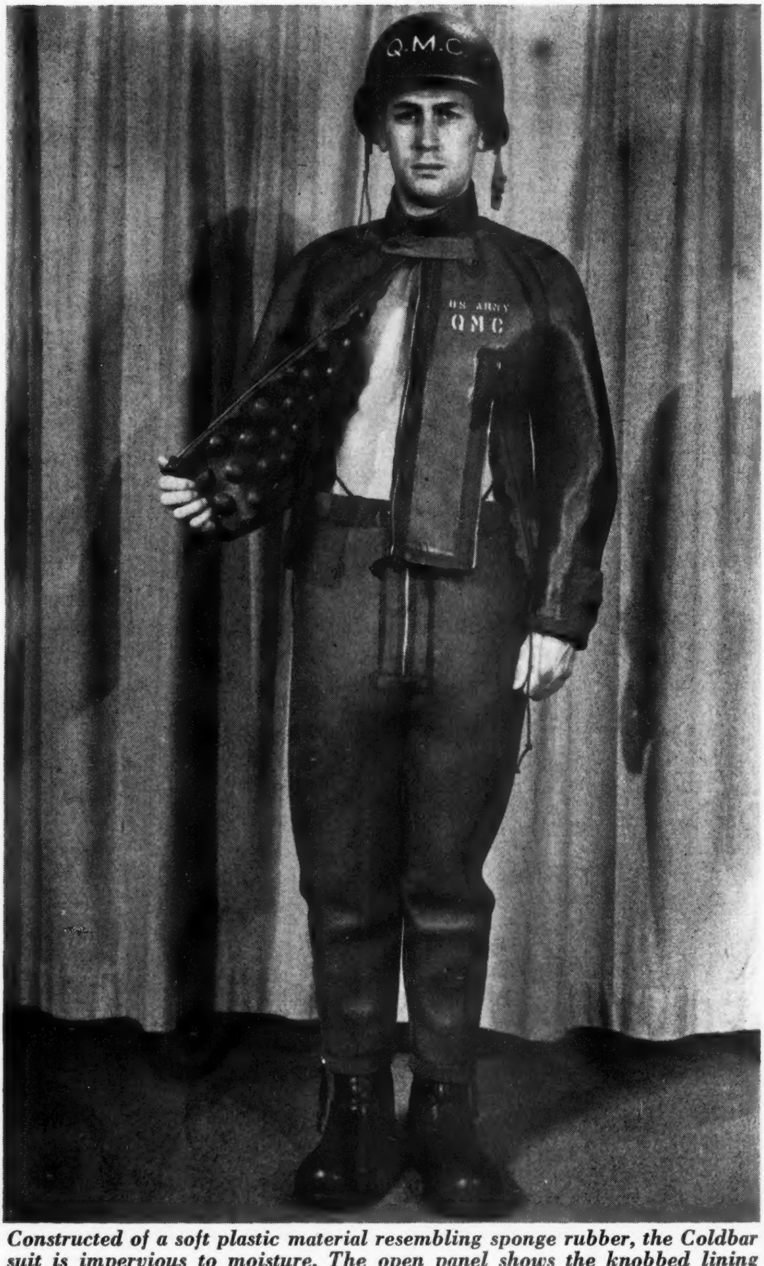
There are four principal ways in which patients are brought

*In addition to the three United States vessels, the British hospital ship HMS *Maine* and the Danish MS *Jutlandia* have served in Korean waters.

aboard for treatment. The simplest is to have the ship tied up to a dock, where ambulances can drive alongside the electric litter hoists. When the vessel rides at anchor, patients can be hoisted from small boats or transferred by a high line from another ship. Finally, there is the helicopter, which may land on the deck or upon a barge moored alongside the ship.

One ship reports that 23 percent of its patients were flown in by helicopters. Speed has proved a life-saver in the handling of neurosurgical cases. Without the help of the 'copters, many of these wounded would have died. But now, a man with a severe wound in the head, chest or abdomen may be undergoing surgery in a matter of a half hour from the time he was hit, thanks to the flying egg-beaters.

Floating hospitals, as distinguished from the older type of evacuation ships, have many advantages over standard medical facilities operating close to the battle-front. Of permanent construction, they are always ready for immediate use; they are mobile and they are self-sufficient. In the future they may be used more widely in disaster and rescue work. For several years Civil Defense officials have been wrestling with a dreaded problem: What happens to the thousands of atomic blast victims still alive in a strategic port city when all the hospital and medical facilities in the area have been crippled? The hospital ship could be the answer.



Constructed of a soft plastic material resembling sponge rubber, the Coldbar suit is impervious to moisture. The open panel shows the knobbed lining which allows air to circulate. **U. S. Army Photograph**

QUARTERMASTER CORPS PLASTICS RESEARCH

JOHN R. HENNESSEY

RECENT SURVEYS have found that there are at least five hundred different kinds of plastic items—from phonograph records to clothes hampers—used in the average American home today. It is not surprising therefore that plastics have entered the life of the soldier, too.

The Army Quartermaster Corps, one of the largest users of plastics among the technical services, has already standardized such plastic items as buttons, helmet liners, mess trays, bread delivery boxes, Arctic sleds and body armor. In the testing stage are such other articles as typewriter cases, pack boards, field desks, trunk lockers and cold weather clothing.

If anything, the future will add more items to the list. Since the discovery in 1863 of the first commercial plastic, cellulose nitrate or celluloid, the plastics industry has grown from a laboratory oddity to a field of discovery which seems to have no bounds. In the last three decades, it has blossomed from a production of a mere three thousand tons in 1922 to an anticipated fifteen million tons this year.

Plastics have many advantages. Since they can be molded into thousands of intricate forms by the application of heat or pressure or both, they are readily mass produced. In the long run this moldability, which eliminates costly machining, usually cuts the item cost. At the same time plastics can often be used to replace scarce metals. Another advantage is their lightness and strength and, finally, they are preferred because of their resistance to rot and corrosion.

The latter advantage is particularly important to the military in peace and war. Unlike commercial buyers who need to allow for only limited storage periods, the Quartermaster Corps must strive to keep its supplies and equipment in serviceable condition for years or decades. Rusting, warping and other kinds of

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deterioration inevitably take their toll during long storage. Plastics, however, are less susceptible to moisture and temperature variations. They resist these destroyers better than conventional materials.

In its quest for more military applications for plastics, the Quartermaster Corps conducts an extensive research program. Some testing is carried on by its own laboratories, but most of the research is done under contract by industrial and university laboratories. Construction of an $11,000,000 laboratory at Natick, Massachusetts, to be completed early in 1954 will consolidate all Quartermaster research work, including that in plastics, under one roof.

Body armor is one of the most recently publicized products of Quartermaster research. It consists of a vest weighing eight pounds made of twelve layers of laminated nylon which protect some six square feet of the upper part of a man's body. Used in Korea, it has already reduced chest and abdominal wounds by 60 to 70 percent. Additional armor for the lower abdominal regions and the legs is being studied.

Before any plastic item is standardized for issue, it must undergo a period of careful testing. First, it is given an engineering test under laboratory controlled conditions. There research scientists watch its reactions under artificially produced conditions of extreme heat, cold, humidity and dryness. Next it gets a service trial. A typical unit at some post, camp or station serves as a "guinea pig" while researchers carefully observe and report on the item's serviceability. Finally it gets a field test. In the case of body armor, the life-saving gear was issued to combat troops in Korea. Several thousand vests were tried out in front line areas and a research team kept careful performance data on each one. By the time all tests were completed, scientists had spent fifteen months on this project alone.

Coldbar cold weather clothing, now in the latter stages of testing, offers another dramatic example of what plastics have to offer the soldier for his future protection and comfort. Researchers already knew that man is a walking heating plant, continuously losing heat to his surroundings. When the net loss of heat equals the output of his heating plant, he is comfortable. Thus a man, dressed in dry wool clothing and walking slowly on a clear, calm day with the thermometer at twenty degrees, finds himself sufficiently warm.

But if the same man's heat losses exceed the heat output of his body, he becomes cold and uncomfortable, eventually to

the point of dangerous exposure. If he suddenly has to crawl on his hands and knees carrying a full pack, he perspires and becomes overheated. Then, when he resumes his leisurely walk, he will feel cold because the insulation of his clothing has been reduced by dampness. If he then has to lie prone on the ground, he will feel still colder, not only because of his reduced activity, but also because compression of his clothing has further reduced its insulation value. Should a wind come up, evaporation of his perspiration will make his situation even worse. Finally, if he

An infantryman indicates where a steel fragment hit his body armor vest while he was on patrol in Korea. U. S. Army Photograph

wades a stream or accidentally falls into a river, he is chilled instantly. The resulting rapid evaporation can be fatal unless he finds warmth and shelter.

If, however, the insulation of his clothing resists water absorption, air and vapor permeation, and compression, the man remains comfortable. These were the very qualities Quartermaster researchers were looking for when they found Coldbar, a vinyl plastic blended with synthetic rubber. This combination was found superior to rock wool, glass wool, hair felt, balsam wool and cork as an insulation against loss of heat through conduction. Only materials such as waterfowl down and the lightest kapok can equal its low thermal conductivity.

In appearance, Coldbar is a lightweight rubberlike product approximately a quarter of an inch thick, which looks and feels something like sponge rubber. There is this important difference in its construction, however, which makes it impervious to air and vapor and which gives it a high insulation quality—each of the thousands of tiny spherical gas bubbles in the material is individually sealed.

This Coldbar material formed a "vapor barrier" which prevented air and perspiration from passing through. This principle conflicted with two cardinal doctrines formerly applied in conventional cold weather clothing—namely, keep the skin and insulating layers dry and do not disturb the human perspiration process. Nevertheless, by preventing evaporation and maintaining a dry insulation layer, Coldbar keeps the loss of body heat to the lowest practical level under the worst possible cold-wet exposure conditions for virtually any length of time.

The Quartermaster Corps also has standardized the use of plastic or synthetic fibers in many military fabrics. Nylon, rayon, dynel, saran and acetate fibers already are being used in such equipment as parkas, sleeping bags, ponchos, jungle boots, musette bags and cargo parachutes. The crease-resistant synthetics—orlon, dacron, dynel and acrilan—are presently under consideration for uniforms, but production of these fibers is not yet large enough for military demands.

The future of plastics in the military field, however, is assured. Familiar barracks queries like "How's your brass?" or "How's your leather?" will give way to "How's your plastic?" Only, in the case of plastics, the odious and continuous chore of polishing or shining will have been eliminated.

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